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CEPHALOMETRIC CHARACTERISTICS IN INDIVIDUALS WITH DIFFERENT TYPES OF VERTICAL GROWTH

КЕФАЛОМЕТРИСКИ КАРАКТЕРИСТИКИ КАЈ ИНДИВИДУИ СО РАЗЛИЧЕН ТИП НА ВЕРТИКАЛЕН РАСТ

Maneva Ristovska M.[1], Dzipunova B.[1], Gavrilovikj I.[1], Bajraktarova- Mishevska C.[1]

[1]Department of Orthodontics, Faculty of Dentistry, University "Ss. Cyril and Methodius" Skopje, Republic of North Macedonia

Abstract

Modern society today considers facial beauty as an important physical attribute. Hence achieving facial harmony and aesthetics referring to orthodontic issues becomes a major imperative. Changes in craniofacial and dentoalveolar structures during growth and development have a major influence on the change of soft tissue structures and periodontal tissues, which significantly changes the external appearance of the patient. The main purpose and task of orthodontic therapy is to correct the imbalance of the craniofacial and dentoalveolar structures and to achieve good occlusion, aesthetics and function. In order to achieve these goals, a series of diagnostic procedures will be required to provide the basic guidelines for orthodontic treatment consisting of phased implementation of certain therapeutic protocols, and often in combination with other dental branches - oral and maxillofacial surgery, periodontology, conservative dentistry. Particularly challenging are the individuals with greater deviation in the vertical dimension due to the need for combined orthodontic-surgical treatment which are the subject of our study. **Key words:** cephalometry, craniomandibular angle, type of growth-hypodivergent, hyperdivergent.

Апстракт

Модерното општество денес ја смета фацијалната убавина како важен физички атрибут. Оттаму и во ортодонцијата постигнувањето на фацијалната хармонија и естетика станува главен императив . Промените на краниофацијалните и дентоалвеоларните структури во текот на растот и развојот имаат големо влијание и на промената на мекотквивните структури и периоралните ткива, со што значително се менува и надворешниот изглед на пациентот. Основна цел и задача на ортодонтската терапија е корекција на дизбалансот на краниофацијалните и дентоалвеоларни структури и постигнување на добра оклузија, естетика и функција. За реализација на тие цели потребно е спроведување на низа од дијагностички процедури кои ќе ги дадат основните насоки на ортодонтскиот третман кој се состои од етапно спроведување на одредени тераписки протоколи, а често пати, истите се во комбинација и со останатите стоматолошки гранки – орална и максилофацијална хирургија, пародонтологија, конзервативна стоматолгија. Посебен предизвик се индивидуите кај кои постои поголемо отстапување во вертикалната димензија, заради потребата од спроведување на комбиниран ортодонтско-хируршки третман и кои се предмет на нашето испитување. **Клучни зборови:** кефалометрија, краниомандибуларен агол, тип на раст- хиподивергентен, хипрдивергентен.

Introduction

The growth and development of the craniofacial system is an individual and genetic conditional process which is manifested by different variations in the size and the shape of these structures. The morphological and clinical features of these changes are correlated with the growth potential of the individual as well as the intertwining combination of the anteroposterior and vertical dimensions that form individuals with different facial features. Teeth, muscles and bones are interconnected and interrelated throughout the process of growth. Disproportions and malposition often lead to the development of malocclusion and certain facial irregularities.

One of the main and primary tasks of orthodontics is to direct the growth and development of the orofacial system and to establish balance between its parts, thereby providing good occlusion, function and facial aesthetics. There are several diagnostic methods for making the correct diagnosis of skeletal disharmony in the orofacial region. Among the most important are profile teleradiography and cephalometric image analysis which allows us to assess dentofacial development and the type of growth of the individual. This method enables the determination of the dimensions of the facial skeleton, the interconnection of bone and soft tissue structures, as well as the characteristics of the jaw bases and dentoalveolar ratios. That is why in orthodontics the primary importance is to make a proper diagnosis and to determine the proper plan of orthodontic treatment.

The technique of X-ray originated from Hofrath and Broadbent who have made use of X-rays to estimate the longitudinal growth of individuals. In its beginnings x-ray cephalometry was developed as means of studying craniofacial growth and development, and later its application was expanded to predict growth and development, as well as to plan the diagnosis and treatment and to evaluate the progress. Steiner emphasizes that the analysis is incomplete until individualization and adjustment of each patient is done individually. Most orthodontic clinicians supplement and refine the analysis, Sassoni, Tweed, Steiner, Shwartz, Ricketss, Solow[1-4].

The type of vertical growth of the face plays a vital role in achieving the facial balance[5]. Variations in the vertical growth are common and have certain orthodontic implications. A "long" or "short" person face may be the result of abnormal proportions of soft and bony structures in the craniofacial region. Excessive vertical growth can result in a gingival smile, incompetent lips and a long face[6]. On the contrary, lack of vertical growth can lead to an inappropriate presentation of the incisors, an inward twist of the lips and a short face[7]. Both types of face are considered to be non-aesthetic and are included in the list of orthodontic irregularities and anomalies.

The treatment of these conditions and irregularities is usually performed through functional jaw orthodontics in persons during their growth or by an orthogonal surgery in adult individuals. The success of an orthodontic treatment plan depends not only on understanding where growth occurs, but also when it is completed[8]. As the vertical component of growth is the last in the growing process, failure to control it can lead to a complex treatment, compromised outcomes and relapse after the treatment[9,10]. This explains the need for a thorough assessment and an accurate diagnostic evaluation of such differences in the vertical growth of the face in order to ensure success in the orthodontic treatment.

Lateral cephalometry facilitates the assessment of vertical skeletal discrepancies. Downs[11] used the Frankfurt Horizontal (FH) as a reference line of lateral cephalograms to estimate mandibular growth, using the Y axis and the mandibular angle of the Frankfurt horizontal (FMA). Steiner[12] uses the anterior cranial base as the reference plane - Sella-Nasion in relation to mandibular plane, the so-called cranio-mandibular angle (SN / MP) to estimate the vertical growth model. Schwarz[13], proposed the angle of the maxillary / mandibular plane (MMA) to evaluate the intermaxillary connection in vertical direction. Later, however, certain linear parameters are used, including the Jarabak's ratio and the ratio of a lower anterior face height to a total anterior face height (LAFH / TAFH), to estimate the vertical facial growth[14].

The mandibular plane as a reference plane and its relation to the surrounding structures is used in many cephalometric analyzes. Namely, it is related to the lower jaw motility, the correlation with TMZ and occlusal relations and the type of growth in horizontal or vertical direction. The craniomandibular angle - SN / MP - a parameter that is independent of the change in sagittal dimension of the mandible is used to define individuals with different types of vertical growth, i.e. individuals with vertical i.e. a hyper divergent type of growth where the values of this angle are greater than 32°, and a hypodivergent type of growth - where the SN / MP angle is less than 32°.

The size of the gonial angle has a significant influence on the degree of expression of the mandibular rotation. A smaller gonial angle results in a greater rotation forward and a shift of the chin and pogonion in the same direction. The blunt angular angle can in turn compensate for the short length of the mandibular body. In fact, the gonial angle provides compensation for the disharmony of facial ratios. The gonial angle is significantly increased in persons with hyperdivergent - a vertical type of growth compared to persons with normal and horizontal growth. The findings reached by many scientists Jensen[15], Schendel[23], Opdebeeck[18], Sassouni et al.[19], Decoster[15], Swinehat EW[15], Hapak[15], Subtelny[20], Nahor[21, 22], Trouten[23], Cangialosi[24] et al.[5] Siriwat[16] also indicate that a blunt gonial angle is associated with a skeletal open bite, while a relatively small gonial angle (a sharp angle) is associated with the presence of a deep bite. According to Sassouni[19], decreased growth in the posterior facial area height and increased anterior lower facial height result in a mandibular rotation downwards and backward with an increasing craniomandibular angle and a gonial angle.

In the study of Guo at all[25], the first group of subjects had a horizontal type of growth, while the second group had a vertical type of growth. Thus, maxillary premolar extraction was indicated only in patients with horizontal growth, whereas bimaxillary premolar extraction was appropriate in patients with moderate or vertical growth. Benett at all[28] studies have shown that persons with a hyperdivergent type of facial growth are more likely to receive dental extraction treatment, while those with a meso-divergent type of growth are more likely to undergo treatment without reduction in the teeth number. According to Shudy[29], tooth extraction contributes to "bite closure" and applies to people with a vertical type of growth.

Kim[30-33] in turn applies a specific model of determining extraction index by applying several parameters ODI - an indicator of vertical maxillomandibular ratio which is indicative of the size of a vertical incisor relation (a sum of angles AB / MPl and SpPl / FH); APDI – an indicator of anteroposterior dysplasia of maxillary mandibular relation (a sum of angles FH / NPg, NPg / AB and SpPl / FH); CF - a balance indicator of horizontal and vertical orofacial skeletal components -∑ (ODI + APDI) and EI -an extraction index- which determines whether extraction is needed or not (∑ CF + IIA + value for protrusion or retraction of the lips) - and it is correlated with the horizontal and vertical components, the interincisal angle and the position of the lips which directly affect the appearance of the person and his aesthetic.

Lin and Gu[42] in their study conclude that more severe forms of Class III malocclusion in permanent dentition can be successfully treated by extraction of the mandibular second molar, especially in persons with a vertical growth type. This allows for greater inclination and movement of the teeth distally, as well as noticeable changes in the soft profile.

Concerning the treatment of Class III malocclusion, Beltrao[43] proceeding from Kim's cephalometric analysis and estimation of the need for extraction concludes that in these subjects good and stable results are obtained by applying camouflage orthodontic treatment that satisfies the aesthetic and the functional aspect. This is especially true for individuals with an open bite and a hyperdivergent type of growth and it is a good alternative to the surgical approach of this malocclusion.

Aims

Establishing a diagnosis thus establishing an orthodontic treatment plan is the basis and a starting point in orthodontics. It does not often indicate the need to reduce the number of teeth, so we often come across the question of how the extraction will affect the individual's external appearance, as well as the functions occurring in the oral cavity (masticatory, phonetic or nutritional function), such as the influence on the general psychosocial health of the person.

The purpose of this study is to predict and determine the orthodontic treatment plan with the help of the examined cephalometric parameters - whether it will be carried out with or without extraction of teeth in the subjects, as well as:

- to evaluate the morphological characteristics in patients with different types of vertical growth,
- to define the relation between Bjork polygon and the craniomandibular angle at different sagittal irregularities in comparison with the craniomandibular angle,
- to estimate the Jarabak ratio at different types of growth in subjects with malocclusion Class II and III and subjects with normocclusion.

Material and method

The study was performed on profile cephalograms of 60 individuals with Class II malocclusion division 1 (distocclusion), 60 individuals with class III malocclusion (mesiocclusion) and 30 individuals with normal occlusion (neutro-occlusion) (Fig.1), aged 12-16 years.

In each study group, cephalograms were divided by the type of growth determined according to the values of the craniomandibular angle (Fig.2) of the persons:

- a hyper divergent i.e. a vertical type of growth where the value of SN / MP angle is greater than 32˚ and
- a hypo divergent i.e. a horizontal type of growth, where the value of this angle is less than 32˚.

Different linear and angular parameters were included for the evaluation of the jaw relationship and the cranial base ratios from the analysis by Steiner, Jarabak and

Fig.1. *Neutroocclusion* *Class II division 1 malocclusion* *Class III maloclussion*

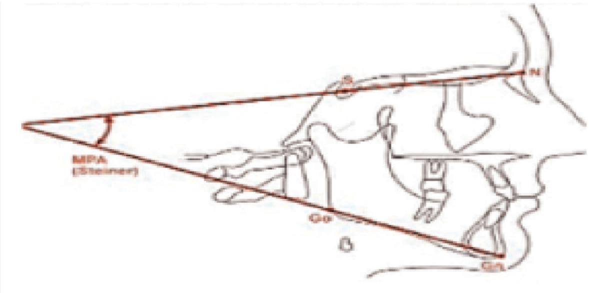


Fig 2. *Craniomandibular angle SN/MPL*

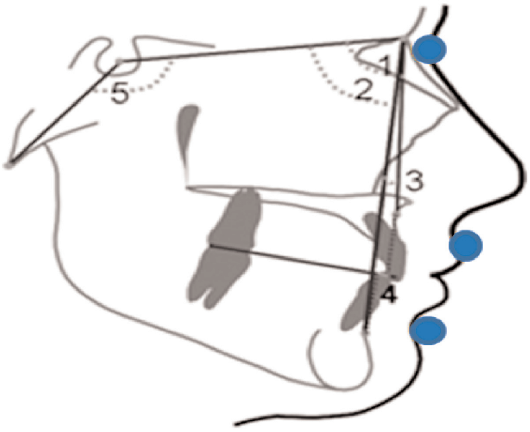


Fig 3. *1-SNA;2-SNB, 3- ANB, 4-OccPl, 5-NSBa*

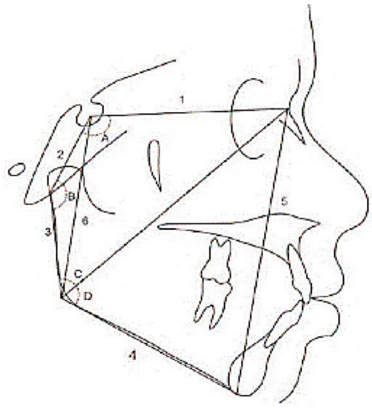


Fig. 4. *A - NSAr; B – SArGo; C + D = ArGoMe*
C - ArGoN (upper gonial angle):
D - NGoMe (lower gonial angle)
A+B+C+D= Bjork polygon

Tweed: SNA, SNB, ANB, NSBa (Fig. 3) as well parameters for vertical growth of Bjork and Jarabak's craniofacial structures (Fig 4.)

Results

The results of our measurements were analyzed with Statistical 7.o and are presented in the following tables.

Table 1 shows the distribution of a type of growth among the subjects with different malocclusion in the class II malocclusion division 1, we have 51.6% of subjects with a horizontal type of growth and 48.4% with a vertical type of growth. In class III malocclusion 48.4% of the subjects are with a horizontal type of growth and 51.6% with a vertical type of growth.

Table 2 and Table 3 provide a descriptive overview of the skeletal ratios of maxilla and mandible, between class I and Class II, and retrospectively class I and Class III as

Table 1. Distribution of subjects with malocclusion according to growth pattern of a craniomandibular angle -SN/MPl

Type of growth	I Class		Class II division 1 Malocclusion		Class III malocclusion	
	n	%	n	%	n	%
Normal growth	30	100,0%	0	0,0%	0	0,0%
Horizontal growth	0	0,0%	30	51,6%	30	48,4%
Vertical growth	0	0,0%	30	48,4%	30	51,6%
Total	30	100,0%	60	100,0%	60	100,0%

Table 2. Characteristics of Angular Skeletal Cephalometric Parameters in individuals with Class I -normal growth type and Class II Malocclusion with Horizontal and Vertical Growth Type

Angular Skeletal Cephalometric Parameters	Class I Normal growth			Class II division 1 Horizontal growth			t	p
	X̄	SD	SG	X̄	SD	SG		
SNA – position of maxilla relative to cranial base	80,65	2,51	0,45	82,66	3,06	0,54	-2,844	0,006 **
SNB –position of mandible relative to cranial base	77,35	2,63	0,47	76,94	2,98	0,53	0,589	0,558
ANB – angle of intermaxillary sagittal relation	3,29	0,90	0,16	5,72	1,11	0,20	-9,493	0,000 ***
SN/MP – craniomandibular angle	32,00	0,00	0,00	27,09	3,48	0,61	7,855	0,000 ***
Angular Skeletal Cephalometric Parameters	**Class I normal growth**			**Class II division 1 Vertical growth**			**t**	**p**
	X̄	SD	SG	X̄	SD	SG		
SNA – position of maxilla relative to cranial base	80,65	2,51	0,45	80,93	3,26	0,59	-0,388	0,700
SNB –position of mandibula relative to cranial base	77,35	2,63	0,47	73,63	3,31	0,60	4,876	0,000 ***
ANB – angle of intermaxillary sagittal relation	3,29	0,90	0,16	7,30	1,78	0,33	-11,133	0,000 ***
SN/MP – craniomandibular angle	32,00	0,00	0,00	39,70	4,67	0,85	-9,184	0,000 ***

Arithmetic mean - X̄
Standard deviation – SD
Default error - SG

p <0, 05 * - low statistical significance
p <0, 01 ** - high statistical significance
p <0, 001 *** - very high statistical significance

well as their relation to malocclusion, in individuals with a horizontal growth type and a vertical type of growth.

The analysis of the angular parameter SNA^0 among the subjects with a class I normal type of growth and a malocclusion class II division 1 with a vertical type of growth, “t" test does not show statistical significance. While the SNB^0 , ANB^0 angle analysis showed very high statistical significance of 0.000 *** among individuals with Class I and Class II division 1 malocclusion with a vertical type of growth, while analysis for the craniomandibular angle SN/ MP^0 - "t" test shows very high statistical significance of 0.000 *** for both types of growth.

Maxillary position relative to the cranial base - SNA^0 in subjects with Class I has a mean of 80.65° , with a standard deviation of 2.51, and in subjects with Class III malocclusion with a horizontal type of growth has a mean value of 80.87 ° and a standard deviation of 3.40, the "t" test shows no statistical significance. Whereas, in the analysis of the angular parameter SNA^0, ANB^0 and SN/MP^0 among subjects with Class I with normal growth and Class III malocclusion with a vertical type of growth, the “t” test shows very high statistical significance of 0.000 ***, as a result of morphological and skeletal characteristics of malocclusions.

Compared to subjects with Class I malocclusion with normal growth and Class II Malocclusion with vertical growth there is a very high statistical significance in two parameters- the gonial angle - ArGoMe (0.000 ***) and Bjork's. polygon (0,000 ***), and low stastistical significance for gonial angle at subjects with horizontal growth compared to the normal ones.

Comparison of subjects with Class I and Class III malocclusion with a horizontal type of growth showed low statistical significance for NSAr -a selar angle (0.012 *), ArGoMe-gonial angle (0.036 *), and Bjork polygon (0.014 *). But there is a very high statistical significance

Table 3. Characteristics of Angular Skeletal Cephalometric Parameters in individuals with Class I Malocclusion and Class III Malocclusion with different growth pattern

Angular Skeletal Cephalometric Parameters	I Class normal growth			III Class Horizontal growth			t	p
	X̄	SD	SG	X̄	SD	SG		
SNA – a position of maxilla relative to cranial base	80,65	2,51	0,45	80,87	3,40	0,62	-0,290	0,773
SNB – a position of mandibula relative to cranial base	77,35	2,63	0,47	83,93	4,00	0,73	-7,617	0,000 ***
ANB – zn angle of intermaxillary sagittal relation	3,29	0,90	0,16	-3,07	2,89	0,53	11,684	0,000 ***
SN/MP – a craniomandibular angle	32,00	0,00	0,00	28,07	3,47	0,63	6,307	0,000 ***
Angular Skeletal Cephalometric Parameters	**Class I normal growth**			**Class II division 1 Vertical growth**			**t**	**p**
	X̄	SD	SG	X̄	SD	SG		
SNA – a position of maxilla relative to a cranial base	80,65	2,51	0,45	77,84	3,22	0,57	3,840	0,000 ***
SNB –a position of mandibula relative to a cranial base	77,35	2,63	0,47	80,06	3,98	0,70	-3,179	0,002 **
ANB – an angle of intermaxillary sagittal relation	3,29	0,90	0,16	0,09	0,30	0,05	19,028	0,000 ***
SN/MP – a craniomandibular angle	32,00	0,00	0,00	39,66	4,08	0,72	-10,454	0,000 ***

Arithmetic mean - X̄
Standard deviation – SD
Default error - SG

p <0, 05 * - low statistical significance
p <0, 01 ** - high statistical significance
p <0, 001 *** - very high statistical significance

Table 4. Bjork polygon and its Angular Cephalometric Parameters at Class I and Class II division 1 with Horizontal and Vertical Growth

Angular Skeletal Cephalometric Parameters	I Class normal growth			Class II division 1 Horizontal growth			t	p
	X̄	SD	SG	X̄	SD	SG		
NSAr – selar angle	123,87	4,88	0,88	124,75	4,56	0,81	-0,739	0,463
SArGo – articular angle	146,26	7,51	1,35	143,19	7,38	1,30	1,637	0,107
ArGoMe – gonial angle	121,84	6,03	1,08	119,25	4,25	0,75	1,975	0,053 *
Bjork polygon	392,00	2,65	0,48	387,19	7,15	1,26	3,519	0,001 ***
Angular Skeletal Cephalometric Parameters	**I Class normal growth**			**Class II division 1 Vertical growth**			**t**	**p**
	X̄	SD	SG	X̄	SD	SG		
NSAr – selar angle	123,87	4,88	0,88	124,67	4,98	0,91	-0,631	0,531
SArGo – articular angle	146,26	7,51	1,35	144,27	6,94	1,27	1,075	0,287
ArGoMe – gonial angle	121,84	6,03	1,08	131,23	6,51	1,19	-5,850	0,000 ***
Bjork polygon	392,00	2,65	0,48	400,17	7,11	1,30	-5,983	0,000 ***

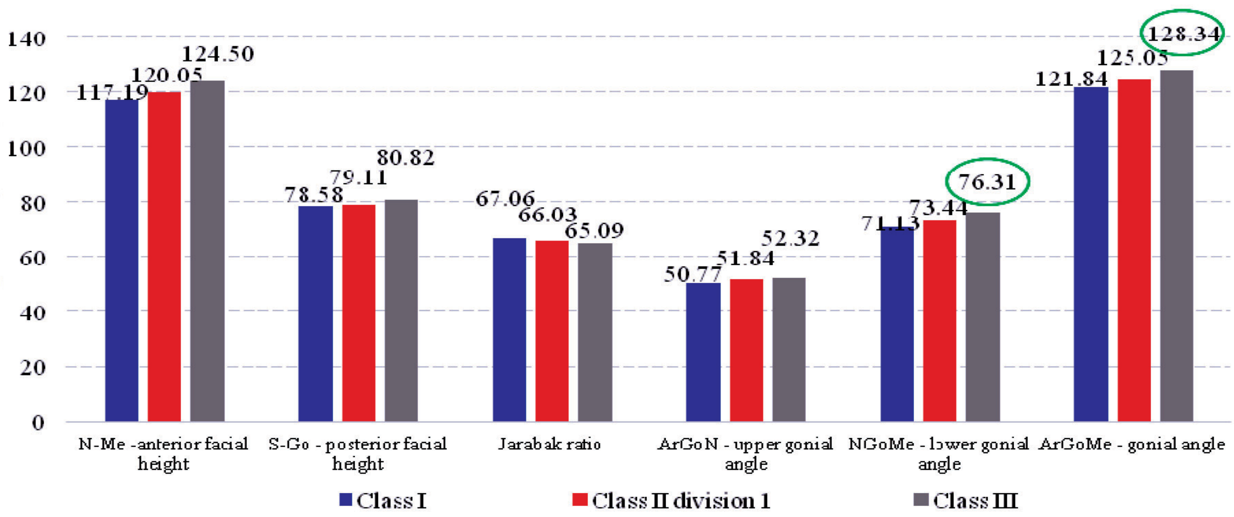
Table 5. Bjork polygon and its Angular Cephalometric Parameters at Class I and Class III with Horizontal and Vertical Growth

Angular Skeletal Cephalometric Parameters	I Class normal growth			Class III Horizontal growth			t	p
	X̄	SD	SG	X̄	SD	SG		
NSAr – selar angle	123,87	4,88	0,88	120,30	5,80	1,06	2,607	0,012 *
SArGo – articular angle	146,26	7,51	1,35	144,07	8,31	1,52	1,081	0,284
ArGoMe – gonial angle	121,84	6,03	1,08	125,00	5,47	1,00	-2,143	0,036 *
Bjork polygon	392,00	2,65	0,48	389,37	5,12	0,94	2,535	0,014 *
Angular Skeletal Cephalometric Parameters	**I Class normal growth**			**Class III Vertical growth**			**t**	**p**
	X̄	SD	SG	X̄	SD	SG		
NSAr – selar angle	123,87	4,88	0,88	121,78	4,88	0,86	1,700	0,094
SArGo – an articular angle	146,26	7,51	1,35	147,38	6,43	1,14	-0,635	0,528
ArGoMe – a gonial angle	121,84	6,03	1,08	131,47	6,11	1,08	-6,297	0,000 ***
Bjork polygon	392,00	2,65	0,48	400,63	3,93	0,70	-10,180	0,000 ***

for the gonial angle - ArGoMe (0.000 ***) and Bjork polygon (0.000 ***) at subjects with vertical growth Compared to subjects with Class I malocclusion with a combined growth type and Class II malocclusion with a vertical type of growth.

That is in corespondence with the findings made by Jensen, Schendel, Opdebeeck, Sassouni et al. , Decoster, Subtelny, Siriwat, -who indicate that an obtuse gonial angle is associated with a skeletal open bite, a long face, a vertical type of growth, while a relatively small gonial angle (a sharp angle) is associated with the presence of a deep bite.

When comparing the subjects with Class I malocclusion with normal growth and Class II malocclusion with a horizontal type of growth we have statistical significance in the following parameters: posterior facial



Graph 1. A presentation of anterior and posterior face height in subjects with malocclusion Class I, Class II division 1 and Class III malocclusion

height - S-Go, Jarabak ratio and a lower gonial angle - NGoMe. Regarding the ratio of Class I and Class II malocclusion with a vertical type of growth, statistically significant differences were found in almost all anterior and posterior parameters, except for posterior facial height - S-Go. "T" test showed very high statistical significance 0.001 *** in anterior face height - N-Me. The lower gonial angle showed high statistical significance for subjects with class II and III with vertical growth in comparison to Class I.

Discussion

For establishing orthodontic diagnosis and planning of orthodontic treatment, it is essential to perform an individual assessment of the craniofacial and dentoalveolar structures in all three dimensions, i.e. in the transverse, vertical and sagittal directions. The vertical facial component is an important aspect of orthodontics during the process of diagnosis and treatment planning by defining variability in treatment planning, mechanics, and facial proportions[44]. Tweed[45] links the stability of the mandibular position to the mandibular position treatment based on vertical growth. As the vertical growth of the person finishes last, the assessment of the face mismatch in the vertical dimension is not only important for accurate diagnosis and effective treatment planning, but also plays a major role and importance in preventing the relapse of the correct malocclusion.

In the past, much attention has been paid to the diagnosis and treatment of anteroposterior ratios of dental arches. However, cases that have been the most difficult to treat and have the lowest success rates and the most unfavorable prognosis are often those with vertical discrepancy. This data is often corroborated by the fact that relapse of the vertical dimension occurs in this group of treated patients.

Predicting the type of growth according to the morphology of the lower jaw of an individual has clinical implications in the planning of the patient's treatment. Namely, the decision to extract individual teeth, the type of anchorage, the mechanics and type of tooth movement, as well as the retention period are greatly influenced by the type of growth of each individual.

Morphological differences between patients with a vertical and a horizontal type of growth also result in a significant difference in mechanical activity and characteristics of the jaw muscles. The gonial angle is increased in patients with a long face or vertical type of growth, thereby reducing the muscle activity of the adductors and vice versa. As the height of the ramus increases, the muscle activity of the masseter increases. Accordingly, patients with a horizontal growth type and so-called "short face" have a significantly greater mechanical advantage over muscle activity than the long face group and the vertical type growth. Some surgical procedures that are used to correct facial dysmorphia can have a significant impact on the mechanical properties of the jaw muscles. Namely, pulling the mandible forward, that is, mesializing it, reduces the strength of the musculature.

This has a great impact on orthodontic tooth movement and must be considered when planning orthodontic treatment with mastectomy since vertical forces are often produced in the process of treating malocclusions, such as when using Class 2 intermaxillary traction or tip back. Sometimes it is also desirable - chewing forces to neutralize the action of these orthodontic forces. In addition, the significance of the effect of the masseteric force on the vertical stability of the outcome of orthodontic treatment is enormous. The new position of the teeth should be compatible with the dynamics of muscle and occlusal forces in all directions and planes. There is a serious risk of extreme migration after tooth extraction in people with vertical growth, so good anchoring is required. Providing and preserving that support zone is a critical factor in managing space in people with vertical growth, as opposed to individuals with horizontal growth or a "short face".

Larger extrusive forces are also needed to overcome increased muscle activity in persons with a hypodivergent growth type (i.e., "short" face), whereas in individuals with a hyperdivergent growth type or in vertical facial types due to leaner muscles, these forces are controlled along with the control of sagittal changes in terms of overcoming mesial migration forces of the teeth.

In individuals with a hyperdivergent growth type, a long face and a skeletal bite, mandibular and ramus surgery must be combined with maxillary intrusion. Otherwise there will be elongation of the ramus, stretching of the pterygoid muscles, and thus the tendency for relapse will be greater.

Conclusion

Our findings indicate that in persons with a hyperdivergent growth type, the maxilla and the mandible are in a retrograde position in individuals with malocclusion class I and II, whereas in subjects with malocclusion class III the maxilla is in a normal relation with other craniofacial structures.

In persons with a hypodivergent growth type there is maxillary prognathism in all sagittal irregularities examined, while the mandible is in relative normognatism, with the exception of malocclusion class III where it has a pronounced ratio in relation to other craniofacial structures.

Mandibular retrognathism is present more in subjects with Class I and II malocclusion, while prognathism - at subjects with Class III malocclusion. The maxillary position varies from normognatism at subjects with Class III, retrognathism at class I, and prognathism at individuals with class II.Facial height is in relation to the craniomandibular angle, especially anterior facial height at subjects with vertical growth and distooclusion. The lower gonial angle is also in relation to a type of growth in hyperdivergent individuals with Class II and Class III malocclusion.

All of these findings lead us to plan determination of the orthodontic treatment which at horizontal growth is mostly without extraction and at individuals with vertical growth there is a need for reduction in the number of teeth so we could establish proper occlusion, function and esthetics.

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